

Remarks:

The Applicant would like to thank the Examiner for carefully reviewing the specification and claims. Please reconsider the application in view of the above amendments and the following remarks.

1. Objection to the Drawings

The informal drawings filed with the application were considered unacceptable for examination purposes. The Applicant submits with this Reply formal drawings, which are believed to be fully responsive to the objection.

2. Claim rejections - 35 U.S.C. § 102(b)

Claims 1, 4 and 7 were rejected as anticipated by Zhang (U.S. Patent No. 6,785,612). The Applicant has amended claims 1, 4 and 7 to include the subject matter of claims 3, 6 and 9, respectively. The additional element provided by inclusion of the subject matter of claims 3, 6 and 9 is “determining a time gradient of the diffractors and attenuating spatial aliasing of specular reflective events in the depth migrated section using the time gradient.” Zhang does not disclose or suggest such determination of time gradient and subsequent attenuation of spatial aliasing of specular reflective events, as the Examiner has himself noted. Accordingly, claims 1, 4 and 7 as amended are not anticipated by Zhang. Claims 3, 6 and 9 have been canceled.

3. Claim rejections - 35 U.S.C. § 103(a)

Claims 2, 3, 5, 6, 8 and 9 were rejected as obvious over Zhang in view of Martinez et al. (U.S. Patent No. 6,826,484). To the extent the rejection may apply to amended claims 1, 4 and 7, which recite the subject matter of claims 3, 6 and 9 in independent form, the Applicant respectfully traverses for the reasons which follow.

First, Martinez et al. does not show the particular elements needed to make the combination of the Applicant's invention that are not shown in Zhang. Claim 1 as amended recites:

- a) performing velocity analysis on a seismic time record section;
- b) depth migrating the time section for offsets exceeding one-half a distance between a seismic energy source and a seismic receiver most distant from the

source during acquisition of seismic data used to generate the time record section;
and
c) determining a time gradient of the diffractors and
d) attenuating spatial aliasing of specular reflective events in the depth migrated section using the time gradient.

In the Office Action it was asserted that Martinez et al. shows determining a time gradient of the diffractors, and attenuating spatial aliasing of specular reflective events in the depth migrated section using such time gradient. Applicant respectfully disagrees. Martinez et al does describe attenuating aliasing by filtering, but the aliasing described in Martinez et al. is in fact time aliasing caused by undersampling of events in time, rather than spatial aliasing. The section cited by the Examiner as showing alias attenuation, col. 2, lines 49-61, actually states, “[t]he input is *duplicated in the time domain for anti-alias filtering* and resample.” [italics added] Note that data are being processed in the time domain, and thus the disclosed process element cannot be dealing with or related to spatial aliasing. Therefore, one affirmative limitation of claim 1 as amended is not shown in Martinez et al.

Further, Martinez et al. does not disclose or suggest determining a time gradient of diffractors. Martinez et al. deals only with imaging of what the Applicant has termed “specular” reflective events, meaning those that are essentially continuous in the horizontal direction. See Applicant’s specification paragraphs [0027] and [0028]. Martinez et al. makes no mention of any type of seismic event other than a specular reflector, as that term is used by the Applicant, and therefore, Martinez et al. cannot disclose determining a time gradient of diffractors if for no other reason than Martinez et al. does not mention diffractors.

Still further, combining the disclosures of Martinez et al. and Zhang does not produce the Applicant’s claimed invention, and there is no motivation to combine such disclosures even if the claimed invention would be produced. Specifically, the Applicant’s claimed invention includes “depth migrating the time section for offsets exceeding one-half a distance between a seismic energy source and a seismic receiver most distant from the source during acquisition of seismic data used to generate the time record section.” Applicant admits that this particular element, properly construed, is in fact shown in Zhang as pointed out by the Examiner but such

showing is fortuitous. The imaging shown in Zhang is for so-called “converted” seismic energy detection, specifically P-S converted waves. P-S converted waves are emitted from the seismic energy source as compressional waves, and travel to the specular reflector at the compressional velocity of the Earth formation. Upon reflection, some of the energy is converted to shear waves, and travels back upwardly through the Earth formation at the shear velocity of the formation where it is detected by seismic sensors that are responsive to shear waves. Because the shear velocity of typical Earth formation is slower than their compressional velocity, it is in fact possible to depth migrate an image at subsurface reflection points more distant than one half the longest offset for a specular reflector. However, that is where the similarity between Zhang and the Applicant’s invention ends. By depth migrating seismic data that include “single mode” energy, meaning that compressional or shear waves imparted into the Earth by the seismic source are detected in the same form, compressional or shear waves, it necessarily follows that images of specular reflectors in the Earth from such detections will be correctly imaged only for reflection points that are at most at one-half the longest source to receiver offset. Therefore to the extent Zhang is believed to disclose depth migrating at the Applicant’s claimed subsurface locations, Zhang does not disclose generating images that may in any way be used to image diffractors using the remaining elements of the Applicant’s claims. The reason is that in the Applicant’s claimed invention, in order to image diffractors, it is necessary to generate an image at a position more distant from the seismic energy source than the greatest possible specular reflection image position. Such imaging is clearly not shown or implied in Zhang or Martinez et al.

The Applicant’s claimed invention then goes on to isolate, from the depth migrated section, images which are generated by diffractors by determining their time gradient and attenuating specular reflector events using the time gradient. Zhang and Martinez et al. only deal with imaging of specular reflectors and thus do not provide any information on how to isolate or segregate image components that result from diffractors in the Earth’s subsurface. Therefore, the Applicant believes that combination of Zhang and Martinez et al. does not produce the claimed invention, nor is there any basis in the Zhang and Martinez et al. disclosures to combine them to

produce the Applicant's claimed invention. Applicant therefore believes that amended claim 1 is patentable over the art of record.

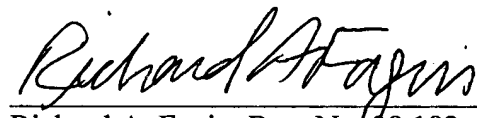
Claim 4 as amended recites the method of claim 1 and includes elements relating to acquisition of the seismic data. Claim 4 is thus patentable over the art of record for at least the same reasons advanced with respect to claim 1. Claim 7 recites a computer program which causes a computer to perform the method of claim 1 and is believed to be patentable over the art of record for at least the same reasons advanced with respect to claim 1.

Claims 2, 5 and 8, depend from claims 1, 4 and 7, respectively and are patentable for at least the same reasons advanced with respect to claims 1, 4 and 7, respectively.

The Applicant believes that this Reply is fully responsive to each and every ground of rejection and objection stated in the Office Action of July 12, 2005, and respectfully requests early favorable action on this application.

Respectfully submitted,

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